Remarks

Claims 1 and 3-21 remain pending in the current application, and Applicants appreciate the Examiner's withdrawal of the previous rejections under 102(e) and 103 over Pierpaoli. By the present amendment, claim 2 has been cancelled and the subject matter combined into amended claim 1, along with support from claim 3. The remaining claim amendments renumber certain claim dependencies and the amendment to claim 16 adds a period to the end of the claim that appears to have been inadvertently omitted in the original filing. No new matter has been added in this response.

Regarding Rejection based on 35 USC §102(b)

Claims 1-13 and 15-21 have been rejected under 35 USC §102(e), as being anticipated by the 1992 paper by Guido Gerig *et al.*, identified as reference #6 in Applicants' Information Disclosure Statement. In making the rejection, the Examiner asserts that Gerig discloses Applicants' method of post-acquisition processing an MRI acquired image by variant anistropic filtering to enhance structure and reduce noise. The Examiner has further most helpfully pointed out a reference in the Gerig paper that appears to relate to each of Applicants' rejected claims. However, the reference to Applicants' claims is only applicable if Gerig first teaches Applicants' method – which Gerig fails to do for a variety of reasons. While Gerig teaches what is now a very old method for improving Magnetic Resonance Imaging (MRI), that method has been improved upon many times in the past 12 years, and the methods taught and claimed by Applicants is not at all the same as that of the cited prior art.

At page 2 of Applicants' specification, Applicants describe a major drawback of space-invariant filtering techniques, *i.e.*, that, along with noise, they often blur important structures. They further explain that to overcome this problem, a variety of local image feature-dependent adaptive filtering strategies have been developed, one of which was gradient-controlled anisotropic diffusive filtering by Perona *et al.* (1990). See page 3 of specification. This method "has become quite popular, and has been further extended and utilized" by Gerig *et al.*, as reported in the paper cited by the Examiner. However, after describing anisotropic diffusive filtering on page 3 of the specification as used by Perona and also by Gerig, Applicants further point out that:

> A significant drawback of this very useful approach, however, is that it does not offer any image-dependent guidance for selecting the optimum gradient magnitude. More importantly, since it does not use any morphological or structural information to control the extent of diffusion in different regions, fine structures often disappear and fuzzy boundaries are further blurred upon filtering.

Anisotropy measures are susceptible and sensitive to background noise, and as a result the main motivation for anisotropic diffusive filtering, such as that which was taught by Gerig so many years ago, was to reduce noise while attempting to minimize blurring across boundaries. However, the accuracy and precision provided by the diffusion anisotropy measures provided by the prior art failed to account for local structure size, therefore images produced by such methods often lost or blurred fine structures and diffused across estimated boundaries. In fact, the disadvantages of such prior art anisotropic diffusive filtering techniques utilized by Perona and Gerig were a specific reason recognized by Applicants as why there was such a need for their invention – that is for a reliable method for filtering SNR and CNR in an MRI acquired image in which intensity gradients are accurately determined, but in which selection of the optimum gradient magnitude is permitted and fine structures are detected. To overcome the problems of diffusive filtering in the prior art, the inventors have, as stated in the specification at page 3, explicitly utilized 'object size' information - or 'scale' - to control the degree of smoothing that is done in different regions of the image. As further explained, the notion of scale, as defined in the subject application, is different from the term 'scale' used in scale-space computer vision literature, although the intent is the same, *i.e.*, to tailor the processing to local object size.

Applicants' space-variant anisotropic (scale-based) post-processing filtering methods are distinguished from the method of quantitatively assessing diffusion anisotropy taught by Gerig. In fact, Applicants' post-processing, scale-based filtering methods outperform the anisotropic diffusive filtering methods of the prior art, including the Gerig method of assessing anisotropy diffusion. Although anisotropic diffusive filtering used by Gerig reduces noise, it does not account for local structure size, and therefore, blurs fine structures and diffuses across boundaries. Anisotropic diffusive filtering as used in the cited prior art fails to consider structural information to control the extent of diffusion in different regions, and as a result, fine structures often disappear and fuzzy boundaries are further blurred upon filtering. Consequently, Applicants' scale-based methods overcome the problems of diffusive filtering of the prior art by

utilizing object size or "scale" information to control the degree of smoothing that is done in different regions of the image.

In comparison with the Gerig technique, which merely provides a method for assessing diffusion anisotropy for a particular MR imaging protocol, as noted in the previous record, Applicants' scale-based filtering methods, and system and device therefor, use structure size information to accurately arrest diffusion around fine structures, and even across low gradient boundaries. Applicants' methods teach imaging the region by any selected MR protocol to form an image, and filtering the acquired image by a scale-based resolution adaptive method. One method uses a weighted average over a scale-dependant neighborhood and the other method employs scale-dependant diffusion conductance to perform filtering. Applicants' scale-based filtering uses the local scale information at every spel to control the extent of filtering. Moreover, Applicants' scale-based methods are effective for any MRI protocol, *e.g.*, T1, T2 and PD, as well as for other imaging modalities, such as, X-ray CT, ultrasound, and natural photographic images.

Consequently, Gerig's method for assessing diffusion anisotropy is entirely different from Applicants' method and Gerig fails to suggest or teach Applicants' method, system or device for post-acquisition, scale-based processing to enhance structure and reduce noise of an MRI image acquired using variant anisotropic filtering. Accordingly, Gerig fails to anticipate Applicants' method, system or device, and Applicants respectfully request that the rejection of claims 1, 3-13 and 15-21 under 35 USC §102 be withdrawn and Applicants' claims be held allowable.

<u>Regarding Rejection based on 35 USC §103</u>

Claim 14 was rejected under 35 USC §103, as being unpatentable over the paper by Gerig *et al*, discussed in detail above, in further view of Levene (U.S. Patent No. 5,743,266). In making the rejection, the Examiner asserts that the disclosure of "permitting production of enhanced real time images" that is missing from Gerig is provided by Levene. However, Applicants respectfully traverse the rejection because even if Levene were to disclose a method of permitting real time images, it still fails –even if combined with Gerig - to disclose Applicants' scale-based, post-acquisition processing of an MRI-acquired image by variant anisotropic filtering to enhance structure and reduce noise, wherein the processing comprises

adaptively modifying degree of filtering at any image location depending on local object size information or scale. Specifically, for the reasons of record and for the reasons noted above, even if combined, the cited prior art references specifically fail to disclose Applicants' spatial-resolution adaptive scale-computation filter method.

Thus, Gerig, alone or in combination with Levene, cannot obviate Applicants' invention specifically as defined by Applicants' claim 14. Accordingly, Applicants respectfully request that the rejection of claim 14 under 35 USC §103(a) be withdrawn and that Applicants' claim 14 be held allowable.

The prior art made of record by the Examiner, but not relied upon as pertinent to Applicants' invention, is noted. Nevertheless, Applicants respectfully submit that all pending claims are in condition for allowance, and request that allowance be granted at the earliest date possible. Should the Examiner have any questions or comments regarding Applicants' amendments or response, the Examiner is asked to contact Applicants' undersigned representative at (215) 575-7034.

If there are any fees due in connection with the filing of this response, please charge the fees to our Deposit Account No. 50-0979.

Respectfully submitted,

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